

L Number	Hits	Search Text	DB	Time stamp
-	0	(313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and (hole\$inject\$4layer) and (hole\$transport\$4layer) and ("emissive layer" "emitting layer") and (electron\$transport\$4layer) and (electron\$inject\$4layer))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 13:53
-	0	(313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (electron\$inject\$4layer)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 11:47
-	441	(313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporing layer") and ("hole transportation layer" "hole-transporting layer"))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 11:53
-	188	((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporing layer") and ("hole transportation layer" "hole-transporting layer")) and ((mg ag al cr mo au pt sn ln al:li ag:mg ag:li) with (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")) ((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporing layer") and ("hole transportation layer" "hole-transporting layer")) and ((mg ag al cr mo au pt sn ln al:li ag:mg ag:li) with (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")) ((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporing layer")) and ((mg ag al cr mo au pt sn ln al:li ag:mg ag:li) with (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")) and (acrylate and (sic sio (silicon near3 nitride)) and (silicon near2 (epoxy acryl\$4)) and (pet pmma fluorine)) (acrylate same (sic sio "sio.sub.2" (silicon near3 nitride)) same (silicon near2 (epoxy acryl\$4)) same (pet pmma fluorine))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 13:31
-	0	((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporing layer")) and ((mg ag al cr mo au pt sn ln al:li ag:mg ag:li) with (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")) ((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporing layer")) and ((mg ag al cr mo au pt sn ln al:li ag:mg ag:li) with (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")) and (acrylate and (sic sio (silicon near3 nitride)) and (silicon near2 (epoxy acryl\$4)) and (pet pmma fluorine)) (acrylate same (sic sio "sio.sub.2" (silicon near3 nitride)) same (silicon near2 (epoxy acryl\$4)) same (pet pmma fluorine))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 11:57
-	2	(acrylate and (sic sio (silicon near3 nitride)) and (silicon near2 (epoxy acryl\$4)) and (pet pmma fluorine))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 12:03
-	94	(acrylate and (sic sio (silicon near3 nitride)) and (silicon near2 (epoxy acryl\$4)) and (pet pmma fluorine))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 12:01
-	2	(\$2acrylate same (sic sio "sio.sub.2" (silicon near3 nitride)) same (silicon near2 (epoxy acryl\$4)) same (pet pmma fluorine))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 12:03

-	1	(((((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (ito and ("hole injection layer" "hole-injection layer" "hole injecting layer" "hole-injecting layer") and ("electron injection layer" "electron-injection layer" "electron injecting layer" "electron-injecting layer") and ("emissive layer" "emitting layer") and ("electron transportation layer" "electron-transportation layer" "electron transporting layer" "electron-transporting layer") and ("hole transportation layer" "hole-transportation layer" "hole transporting layer" "hole-transporting layer")))) and ((mg ag al cr mo au pt sn ln al:li ag:mg ag:li) with (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")))) and organic) and (protect\$3 barrier moisture)) and ((protect\$3 barrier moisture) same acrylate) ("6522067").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 13:47
-	2		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 13:47
-	93	(313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (("stearyl acrylate" "lauryl acrylate" "isodecyl acrylate" "isooctyl acrylate") and (acrylate near2 silic\$3))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 13:58
-	28	((313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (("stearyl acrylate" "lauryl acrylate" "isodecyl acrylate" "isooctyl acrylate") and (acrylate near2 silic\$3))) and fluorine	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 13:55
-	0	(313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (("stearyl acrylate" "lauryl acrylate" "isodecyl acrylate" "isooctyl acrylate") and (acrylate near2 silic\$3)) with (moisture barrier protect\$3))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 14:00
-	2	(313/500,501,502,503,504,505,506,507,508,509,5010,511,512.ccls. 428/\$.ccls. 257/\$.ccls.) and (("stearyl acrylate" "lauryl acrylate" "isodecyl acrylate" "isooctyl acrylate") and (acrylate near2 silic\$3)) same (moisture barrier protect\$3))	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 14:01
-	2	("20020113241").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/04/28 14:48
-	2	("6522067").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 11:46
-	2	("20020180350").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 11:55
-	12	((("5629389") or ("5747182") or ("5844363") or ("5872355") or ("5902688") or ("5948552"))).PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 11:56
-	5	((("5629389") or ("5747182") or ("5844363") or ("5872355") or ("5902688") or ("5948552"))).PN.) and (ito izo "tio.sub.2" "sio.sub.2" "si.sub.3 n.sub.4")	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 13:24

-	1747	313/346r.ccls.		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 13:53
-	20	kim-myung-seop.in. song-won-jun.in.		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 13:32
-	4338	313/346r,498,503,506.ccls.		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 13:53
-	14	313/346r.ccls. and (el electroluminescent)		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 13:53
-	2172	313/498,506.ccls.		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 13:54
-	1894	313/506.ccls.		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/25 09:59
-	0	313/506.ccls. and (duplicate near3 electrode)		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 14:04
-	0	313/506.ccls. and (duplicate near3 cathode)		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/21 14:05
-	1891	313/506.ccls. and (metal li lithium be beryllium na sodium mg magnesium potassium calcium ca rb rubidium sr strontium cs cesium ba barium fr francium ra radium sc scandium ti titanium vanadium cr chromium mn manganese fe iron co cobalt ni nickel cu copper zn zinc al aluminum ga gallium y yttrium zr zirconium nb niobium mo molybdenum tc technetium ru ruthenium rh rhodium pd palladium ag silver cd cadmium in indium sn tin lu lutetium hf hafnium ta tantalum w tungsten re rhenium os osmium iridium irridium pt platinum au gold tl thallium pb lead bismuth bi po polonium la lanthanum ce cerium pr praseodymium nd neodymium pm promethium sm samarium eu europium gd gadolinium tb terbium dy dysprosium ho holmium yb ytterbium tm thulium)		USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/25 10:15

-	1676	(313/506.ccls. and (metal li lithium be beryllium na sodium mg magnesium potassium calcium ca rb rubidium sr strontium cs cesium ba barium fr francium ra radium sc scandium ti titanium vanadium cr chromium mn manganese fe iron co cobalt ni nickel cu copper zn zinc al aluminum ga gallium y yttrium zr zirconium nb niobium mo molybdenum tc technetium ru ruthenium rh rhodium pd palladium ag silver cd cadmium in indium sn tin lu lutetium hf hafnium ta tantalum w tungsten re rhenium os osmium iridium irridium pt platinum au gold tl thallium pb lead bismuth bi po polonium la lanthanum ce cerium pr praseodymium nd neodymium pm promethium sm samarium eu europium gd gadolinium tb terbium dy dysprosium ho holmium yb ytterbium tm thulium)) and transparent	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/10/25 10:18
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US 20010000005A1

(19) **United States**(12) **Patent Application Publication**

Forrest et al.

(10) Pub. No.: **US 2001/0000005 A1**

(43) Pub. Date:

Mar. 15, 2001(54) **TRANSPARENT CONTACTS FOR ORGANIC DEVICES**(76) Inventors: **Stephen R. Forrest**, Princeton, NJ (US); **Mark E. Thompson**, Anaheim Hills, CA (US); **Paul E. Burrows**, Princeton, NJ (US); **Vladimir Bulovic**, Metuchen, NJ (US); **Gong Gu**, Princeton, NJ (US)

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(21) Appl. No.: **09/726,482**(22) Filed: **Dec. 1, 2000****Related U.S. Application Data**

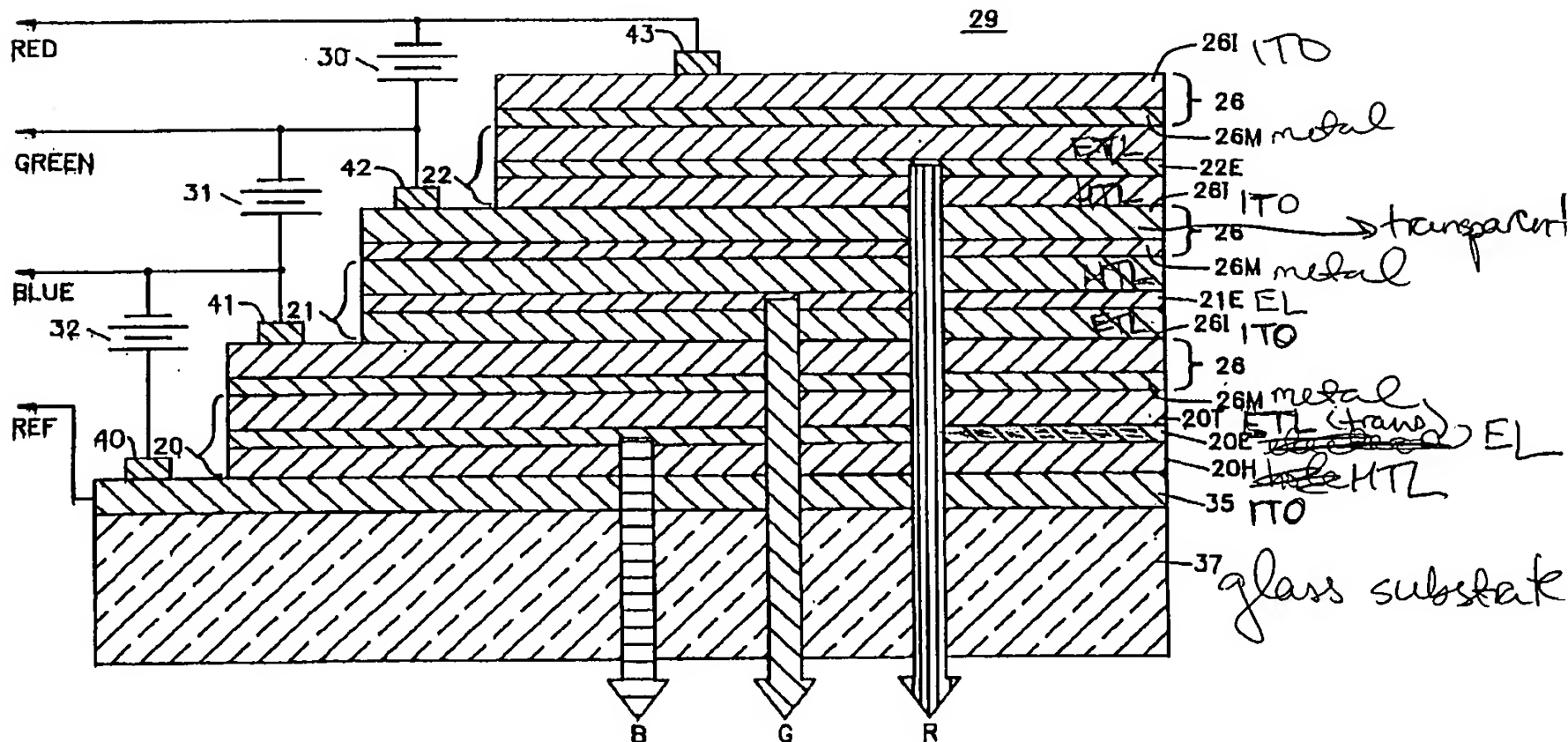
(60) Division of application No. 09/468,986, filed on Dec. 21, 1999, which is a continuation of application No. 08/872,560, filed on Jun. 10, 1997, which is a division of application No. 08/613,207, filed on Mar. 6, 1996, Pat. No. 5,703,436, which is a continuation-in-part of application No. 08/354,674, filed on Dec. 13, 1994, Pat. No. 5,707,745.

Publication Classification(51) Int. Cl.⁷ **H01J 1/62**(52) U.S. Cl. **204/192.12; 204/192.26; 428/432; 257/440; 257/443; 313/506; 313/503; 313/509**

(57)

ABSTRACT

A multicolor organic light emitting device employs vertically stacked layers of double heterostructure devices which are fabricated from organic compounds. The vertical stacked structure is formed on a glass base having a transparent coating of ITO or similar metal to provide a substrate. Deposited on the substrate is the vertical stacked arrangement of three double heterostructure devices, each fabricated from a suitable organic material. Stacking is implemented such that the double heterostructure with the longest wavelength is on the top of the stack. This constitutes the device emitting red light on the top with the device having the shortest wavelength, namely, the device emitting blue light, on the bottom of the stack. Located between the red and blue device structures is the green device structure. The devices are configured as stacked to provide a staircase profile whereby each device is separated from the other by a thin transparent conductive contact layer to enable light emanating from each of the devices to pass through the semitransparent contacts and through the lower device structures while further enabling each of the devices to receive a selective bias. The devices are substantially transparent when de-energized, making them useful for heads-up display applications.



HTL, ETZ, ITO, metal + organic EL layers are transparent